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HAMILTON STREET

RAILWAY TRANSIT

SURVEY

HAMILTON-WENTWORTH RAPID TRANSIT PROJECT

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For Submission By: Metro Canada Limited

To: The Regional Municipality
of Hamilton-Wentworth

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THE HAMILTON STREET RAILWAY TRANSIT SURVEY

S U M M A R Y

This report is presented in brief and describes the concept, design and operation of the Hamilton Street Railway Transit Survey conducted between December 16 and 18, 1980.

The need for the transit survey was to provide data on up-to-date transit passenger demand on Hamilton Mountain Access routes. In order to secure data on transit demand a three-part survey was carried out. Part one was an on-board questionnaire survey which was distributed to passengers while boarding their bus. The second part was a count of boarding and departing passengers at each bus stop. The third part consisted of traffic flow, vehicle occupancy and vehicle classification counts on all Hamilton Mountain Access Routes for the purpose of identifying the p.m. peak traffic period and to determine traffic volumes as well as the transit modal split during that time.

The collection of data by all surveys was successfully completed. However, it was possible to survey only a sample population of transit riders due primarily to non-responses. The report describes the types of correction factors to be developed to properly adjust the surveyed data. Other factors to be applied to the surveyed data in order to establish information such as average daily and weekly passenger volumes, etc., for both current and future scenarios are also described in this report.

Also presented in this report are the findings of a detailed transit ridership analysis for the Hamilton Street Railway System.

The purpose of the analysis was to provide current information about the p.m. peak hour direction travel demand and trip characteristics for Hamilton transit riders.

Among the findings of this report are the following:

- the p.m. peak hour for all the Mountain bus routes combined was 4:00 p.m. to 5:00 p.m. The peak direction was southbound.

- the total number of transit trips which originated below the Mountain and terminated on the Mountain during the p.m. peak hour was 2303 (excluding the "Fennell" route which uses the Kenilworth Access).

- over 75 percent of p.m. peak hour trips destined to the Mountain originated in the CBD area.

- 33 percent of p.m. peak hour trips from Lower Hamilton to the Mountain during the p.m. peak hours required a transfer in the CBD. Only 7 percent required a transfer on the Mountain.

HAMILTON STREET RAILWAY RIDERSHIP SURVEY ANALYSIS
A SPECIAL REPORT

S U M M A R Y

Presented in this report are the findings of a detailed transit ridership analysis for the Hamilton Street Railway System.

This report is a supplement to the report entitled The Hamilton Street Railway Transit Survey: A Sub-Report to the Hamilton-Wentworth Rapid Transit Project, dated February 20, 1981.

The purpose of the following report was to provide current information about the p.m. peak hour peak direction travel demand and trip characteristics for Hamilton transit riders.

Among the findings of this report are the following:

- the p.m. peak hour for all the Mountain bus routes combined was 4:00 p.m. to 5:00 p.m. The peak direction was southbound.

- the total number of transit trips which originated below the Mountain and terminated on the Mountain during the p.m. peak hour was 2 303 (excluding the "Fennell" route which uses the Kenilworth Access).

- over 75 percent of p.m. peak hour trips destined to the Mountain originated in the CBD area.

- 33 percent of p.m. peak hour trips from Lower Hamilton to the Mountain during the p.m. peak hour required a transfer in the CBD. Only 7 percent required a transfer on the Mountain.

TABLE OF CONTENTS

		PAGE NO.
1.	INTRODUCTION	1
2.	PURPOSE OF HSR TRANSIT SURVEY	1
3.	CONCEPT AND DESIGN OF HSR TRANSIT SURVEY	2
4.	OPERATION OF HSR TRANSIT SURVEY	5
5.	ADJUSTMENTS TO DATA COLLECTED	6
6.	PRELIMINARY HSR SURVEY RESULTS	9
7.	PURPOSE OF DETAILED SURVEY DATA ANALYSIS	17
8.	RIDERSHIP ADJUSTMENT	18
9.	GENERAL P.M. PEAK HOUR RIDERSHIP CHARACTERISTICS	23
10.	ORIGINS-DESTINATIONS	28
	10.1 Origins	28
	10.2 Destinations	28
11.	TRANSFERS	34
12.	TRANSIT DEMAND IN SPECIFIC MOUNTAIN CORRIDORS	37
13.	CONCLUSIONS	39
14.	APPENDIX A - Map of HSR Bus Routes Surveyed	40

LIST OF FIGURES

FIGURE		PAGE NO.
3.1	HSR Bus Survey Form	3
9.1	Distribution of Southbound Transit Trips by City Area	24
9.2	Percent Distribution of Southbound CBD/Mountain Peak Hour Trips	25
9.3	Per Capita Peak Hour CBD/Mountain Ridership by Superzone	26
9.4	Per Capita Ridership of Superzones vs. Distance from CBD	27
10.1	Distribution of Total Southbound Peak Hour Mountain Trip Origins	29
10.2	Distribution of Southbound Peak Hour Trip Boarding Origins	30
10.3	Distribution of Peak Hour Rider Destinations for Trips Originating Below the Mountain	31
10.4	Distribution of Southbound Peak Hour Trip Destinations Below the Mountain	32
10.5	Distribution of Southbound Peak Hour Deboardings Below the Mountain	33
11.1	Transfer Activity at Gore Park by Transfer Route for Southbound Peak Hour Trips up the Mountain	35
12.1	Passenger Catchment Area for Sanatorium and Concession Corridors	38

LIST OF TABLES

TABLE		PAGE NO.
8.1	Questionnaire Survey Reponse by Route	19
8.2	Southbound Passenger Ridership Crossing the Escarpment	21
8.3	Peak Hour Southbound CBD/Mountain Ridership by Route	22
11.1	CBD Transfer Activity for Mountain-Destined Routes by Lower City Route	36

1. INTRODUCTION

On December 2, 1980 Marshall Macklin Monaghan Limited was retained by the Urban Transportation Development Corporation to design and undertake an on-board transit passenger demand survey. This report outlines the scope, concept, design details, and staffing of the survey and presents a compendium of the results of the survey. Also presented in this report are the findings of a more detailed analysis of the survey data.

2. PURPOSE OF HSR TRANSIT SURVEY

Briefly, the purpose of the Hamilton Street Railway (HSR) Transit Survey was to acquire an up-to-date data base on the p.m. peak travel demand and trip characteristics of passengers using bus routes which operate between the Hamilton Mountain and Hamilton's downtown. More specifically, the objectives of the HSR survey were to:

1. Collect passenger boarding and departing volumes for all buses on selected Hamilton Mountain bus routes.

2. Survey by questionnaire the trip characteristics (i.e., origin, destination, trip frequency, transfers, etc.) of passengers riding the selected Hamilton Mountain bus routes.

3. Conduct 24-hour ATR counts in both directions on all Hamilton Mountain Access roads during the same week as the bus survey.

4. Carry out vehicle occupancy and classification counts in both directions on all Hamilton Mountain Access roads in conjunction with the bus surveys.

3. CONCEPT AND DESIGN OF HSR TRANSIT SURVEY

To collect the desired data, surveyors were assigned to each bus operating on a Hamilton Mountain route during the afternoon period of 2:30 p.m. to 6:00 p.m. The following twelve bus routes and corresponding route numbers were identified for the survey:

Fennel (31)	Upper James Claremont (27B)
Garth (32)	Upper Kenilworth (21)
Sanatorium (33, 33A, 51)	Upper Ottawa (22, 22A)
Upper Gage (23, 23A)	Upper Paradise (34)
Upper James (27, 27A)	Upper Sherman (24, 24A)
Upper Wellington (26)	Upper Wentworth (25)

A map illustrating the location of each route is shown in Appendix A.

While on board the buses, surveyors distributed questionnaires to passengers boarding at each bus stop. The questionnaire included questions relating primarily to the trip origin and trip destination characteristics of passengers on each bus route surveyed (refer to Fig. 3.1). Other questions related to trip purpose, trip frequency, rider type and gender. Passengers were also given an opportunity to comment on the service of HSR's current transit system.

In addition to distributing the questionnaires, surveyors were required to record the number of passengers boarding and departing the bus at each stop. Boarding and departing counts were recorded on separate bus runs. Boarding counts were recorded on all bus runs travelling up the Hamilton Mountain while departing counts were recorded on runs travelling down the Hamilton Mountain. The time and total onboard occupancy were recorded when buses, travelling in either direction, reached the Hamilton Mountain Access roads (eg., Jolley Cut).

IN ORDER THAT WE MAY CONTINUE TO IMPROVE SERVICE TO YOU, THE HAMILTON STREET RAILWAY IS CONDUCTING A SURVEY DESIGNED TO KEEP US INFORMED ON THE LATEST TRAVEL HABITS, DESIRES AND GENERAL CHARACTERISTICS OF PASSENGERS USING THE TRANSIT SYSTEM.

PLEASE ANSWER AS MANY QUESTIONS AS POSSIBLE AND DEPOSIT THE CARD IN THE BOX PROVIDED AT THE REAR OF THE BUS. THANK YOU FOR YOUR CO-OPERATION.

F.A. COOKE
GENERAL MANAGER

Per Office Use Only

1. I BOARDED THIS BUS AT: (check one) — 1 4
   - [1] ☐ CORE PARK
   - [2] ☐ ST. JOSEPH'S HOSPITAL
   - [3] ☐ OTHER _____ (nearest intersection)

2. TO GET TO THIS STOP I: (check one) — 5 8
   - [1] ☐ WALKED
   - [2] ☐ TRANSFERRED FROM H.S.R. _____ (route)
   - [3] ☐ TRANSFERRED FROM GO BUS
   - [4] ☐ TRANSFERRED FROM CANADA COACH LINE BUS
   - [5] ☐ OTHER _____ (please specify)

3. BEFORE BOARDING THIS BUS, I STARTED MY TRAVEL AT: — 9 12

   _____ (address OR nearest intersection)

   WHICH IS THE LOCATION OF: (check one) — 13
   - [1] ☐ HOME
   - [2] ☐ PLACE OF WORK
   - [3] ☐ SCHOOL/UNIVERSITY
   - [4] ☐ SHOPPING/PERSONAL BUSINESS
   - [5] ☐ SOCIAL, RECREATIONAL
   - [6] ☐ OTHER _____ (please specify)

4. I WILL GET OFF THIS BUS AT: — 14 17

   _____ (nearest intersection OR place name)

(OVER)

5. AFTER LEAVING THIS BUS, I WILL CONTINUE TO: — 18 21

   _____ (address OR nearest intersection OR place name)

   WHICH IS THE LOCATION OF: (check one) — 22
   - [1] ☐ HOME
   - [2] ☐ WORK
   - [3] ☐ SCHOOL/UNIVERSITY
   - [4] ☐ SHOPPING/PERSONAL BUSINESS
   - [5] ☐ SOCIAL/RECREATIONAL
   - [6] ☐ OTHER _____ (please specify)

6. TO GET TO MY FINAL DESTINATION I WILL: (check one) — 23 26
   - [1] ☐ WALK
   - [2] ☐ TRANSFER TO H.S.R. _____ (route)
   - [3] ☐ TRANSFER TO GO BUS
   - [4] ☐ TRANSFER TO CANADA COACH LINE BUS
   - [5] ☐ OTHER _____ (please specify)

7. I MAKE THIS TRIP: (check one) — 27
   - [1] ☐ 5 OR MORE DAYS PER WEEK
   - [2] ☐ 3 - 4 DAYS PER WEEK
   - [3] ☐ 1 - 2 DAYS PER WEEK
   - [4] ☐ LESS OFTEN

8. ARE YOU A LICENSED DRIVER? — 28
   [1] ☐ YES [2] ☐ NO

9. DO YOU HAVE A CAR AVAILABLE FOR THIS TRIP? — 29
   [1] ☐ YES [2] ☐ NO

10. ARE YOU [1] ☐ MALE [2] ☐ FEMALE — 30

11. THANK YOU FOR TAKING THE TIME TO ANSWER OUR QUESTIONNAIRE. DO YOU HAVE ANY SUGGESTIONS FOR SERVICE IMPROVEMENTS TO THE H.S.R. — 31 34 / 35 38 / 39 42

    _____
    _____
    _____

PLEASE DEPOSIT YOUR COMPLETED QUESTIONNAIRE IN THE BOXES AT THE REAR DOORS BEFORE YOU LEAVE THIS BUS.

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HAMILTON, ONTARIO

FIGURE 3.1

HSR BUS SURVEY FORM

Two traffic surveys were carried out in conjunction with the bus survey. The purpose of the surveys was to identify the p.m. peak traffic period and determine traffic volumes as well as the transit modal split during this time.

To determine the 24-hour volume count of traffic in both directions, automatic traffic recorders (ATR) were set up on each of the Mountain Accesses and were operated continuously for the entire week of December 15-21, 1980. Vehicle occupancy and classification counts were carried out between 2:00 p.m. and 7:00 p.m. on each of the days of the bus surveys. These counts were co-ordinated with the on-board bus surveys to ensure traffic and transit data was available for each road on the same day.

4. OPERATION OF HSR TRANSIT SURVEY

Because of manpower limitations, the twelve bus routes were grouped as follows:

Tuesday December 16, 1980		Wednesday December 17, 1980		Thursday December 18, 1980	
Fennell	(37)	Upper Gage	(34)	Upper James Claremont	(22)
Garth	(25)	Upper Kenilworth	(31)	Upper James	(49)
Upper Paradise	(22)	Upper Ottawa	(26)	Upper Wentworth	(38)
Sanatorium	(26)	Upper Sherman	(38)	Upper Wellington	(36)
	(110)		(129)		(145)

Shown in brackets is the number of bus runs surveyed on each route and the total for each day.

Twenty-five students were employed over the three days to handle the survey tasks which required a total of approximately 475 man-hours. Three Marshall Macklin Monaghan Limited staff were assigned to supervisory roles responsible for the proper administration of the survey operations. They were Mr. John Greenough, Mr. Graham Vincent and Mr. Steve Cripps. The overall design and operation of the survey was conducted under the direction of Mr. Rob Wanless and Mr. Ed Filipowich.

To help ensure the success of the survey the Hamilton Street Railway provided two transit supervisors on each of the survey days to assist the staff supervisors in the task of co-ordinating surveyor/bus assignments. Contact with the Hamilton Street Railway Company was made through Mr. Nick Shamrock, Research Manager.

A total of 6 280 questionnaires were distributed during the survey of which 607 (9.7%) were unusable for reasons of incompleteness or illogical answers leaving 5673 questionnaires valid for analysis. In terms of the total ridership on all the bus routes surveyed, the number of valid questionnaires received represented 42 percent of the 13 639[1] riders counted.

The boarding and departing counts were recorded for all regularly scheduled bus runs on all Mountain Access routes. The term "extra bus" is defined by Hamilton Street Railway as a bus which after the completion of a previous transit/or charter assignment slips into a bus route, and is scheduled to operate for at least one or more runs. Sixteen such extra buses were introduced into bus schedules on various routes during the three days of surveying. None of these extra buses were surveyed due to staffing limitations.

All traffic counts were carried out by the City of Hamilton Department of Traffic under the direction of Mr. Ted Gill, Traffic Planning Engineer. The data on traffic volumes and vehicle occupancy and classification were recorded and summarized.

A detailed summary of the preliminary findings of the HSR survey is presented in Section 6 of this report.

5. ADJUSTMENTS TO DATA COLLECTED

Because of the nature of the method of data collection, a number of factors must be developed to generate confident values for the following transit information.

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1 Includes estimate of ridership on 13 "extra buses" which were not surveyed.

1. average daily passenger volumes
2. average weekly passenger volumes
3. various trip origin/destination distribution matrices
4. peak boarding/departing volume profiles
5. peak-hour transfer activity
6. trip distribution by trip purpose
7. modal split
8. captive/choice ridership

More specifically, factors must be developed to correct the non-response rate experienced by the survey. Furthermore, a number of passenger volume adjustment factors must be developed in order to investigate comparisons of the data surveyed with historical records on the basis of standard references (i.e., peak-hour and daily averages, etc.). Lastly, other adjustment factors must be developed to provide forecasts of transit demand (such as passenger volumes, transfer activity, etc.) for the chosen horizon year.

The adjustment factors that must be considered in order to provide confident results are described below. The information used for estimating all factors will be taken from data collected during the period of 3:00 p.m. to 5:30 p.m. (It was during this time that all buses were simultaneously surveyed).

1. "Extra Bus" Passengers Volume Factor - this factor accounts for the volume of transit passengers not surveyed as a result of precluding the extra buses from the survey. This factor will be developed on the basis of averaged passenger volume on buses immediately preceding and immediately following each extra bus.

2. Non-Response Factor - based on the records of total passenger volumes per route surveyed and the number of survey questionnaires answered, the ratio of response by route and total routes are determined.

3. Average Daily Volume Factor - an attempt to develop this factor will be on the basis of historical records showing the relationship between afternoon and 24-hour passenger volumes.

4. Average Weekly Volume Factor - this factor may be estimated by use of historical records showing the relationship between average daily and weekly passenger volumes.

5. Average Peak-Hour Volume Factor - based on established estimates for 24-hour volumes coupled with historical records showing the relationship between peak-hour and 24-hour passenger volumes, this factor may be estimated.

6. Per Capita Ridership - in order to properly determine the transit ridership generated from future residential developments, transit ridership rates corresponding to zones of similar socio-economic and demographic characteristics must be estimated on a per capita basis for each Mountain residential zone.

6. PRELIMINARY HSR SURVEY RESULTS

I BUS SURVEY SUMMARY

- Survey Days - Tuesday, Dec. 16, 1980
  Wednesday, Dec. 17, 1980
  Thursday, Dec. 18, 1980

- Survey Period 2:30 to 6:00 p.m. (Northbound and Southbound Trips)

12	Mountain Access bus routes
13 623	passengers counted
6 280	questionnaires returned (46.1%)
5 673	(or 90.3 %) useable questionnaries (41.6%)

- 3:00-5:30 Period, Southbound Across Escarpment

  4272 passenger trips
  1932 useable questionnaires (45.2%)

- Peak Hour (4:00 - 5:00 p.m.) Southbound Across Escarpment

  2005 passenger trips

II TRAFFIC SURVEY SUMMARY

- Survey Days - same as for bus survey
- Survey Period - 2:30 to 7:00 p.m.
- All seven Mountain Accesses surveyed

- 3 - 5:30 PM Period

Southbound	27 802 person trips
50%	Modal Split on Jolley cut
17%	Modal Split on all Mountain Access Routes
1.3	Persons/automobile (Avg. Car Occupancy)
Northbound	13 071 person trips
35%	Modal Split on Jolley Cut
18%	Modal Split on all Mountain Access Routes
1.4	Persons/automobile

- Peak Hour (4:00 - 5:00)

Southbound	13 125 person trips
49%	Modal Split On Jolley Cut
17%	Modal Split on all Mountain Access Routes
1.3	Persons/automobile
Northbound:	5 320 person trips
30%	Modal Split on Jolley Cut
18%	Total Modal Split
1.3	Persons/automobile

III SERIES "A" CROSS TABULATION SUMMARY

The summary below is based on responses to 2 706 survey questionnaires corresponding to southbound trips only during the 3:00 - 5:00 p.m. period. All percentages have been adjusted to a 100% response equivalent.

- Non-Response Rate for each question ranged between 2% and 12%
- 900 trips (33%) transferred from HSR buses at the bus trip origin.
- 1 708 trips (64%) made no transfer at the bus trip origin (i.e. walked to bus).
- 121 trips (4.5%) made transfers to an HSR bus at the bus trip destination.
- 93% of trips did not transfer to an HSR bus at the bus trip destination (i.e. walked to final destination).
- Trip Origin Activity
  - 43% Work
  - 22% School/University
  - 15% Shopping/Personal Business
  - 14% Home
- 84% of trips destined for home.
- Trip Frequency
  - 78% - 3 days or more per week.
  - 65% - 5 days or more per week.
- 67% captive trips
- At least 48% capitve riders
- Ridership composed of 66% women.

The following section presents a more detailed summary of the Series "A" Cross Tabulation.

DETAILED CROSS-TAB SUMMARY
SERIES A

Sample Size = 2706

A. HSR BUS TRANSFERS AT ORIGIN-END OF TRIP (BY ROUTE)

1. 900 origin transfers

2. Major transfer routes:

Routes Transferred From		Number of Transfers		Routes "Transferred To" Grouped By Percent of No. of Transfers		
	Route No.	No.	%	10-15%	15-20%	20%
Unknown		115	13			
King	(1)	219	24	24	25, 27	
Barton	(2)	101	11	23, 24, 25, 26, 27		
Bay Front	(4)	63	7	23, 26, 27, 22		
Delaware	(5)	126	14	21, 22, 24, 27	26	
Fennel	(31)	77	9	23, 32	22, 33	21
Mohawk	(41)	56	6	22, 27	22	23
Other		143	16			
Total		900	100			

3. On most routes, approximately 10% of riders transferred to the bus for southbound trips. The notable exceptions were route 28 (Upper James/Claremont) with less than 3% and route 27 (Upper James) with just over 14%.

B. ACCESS MODE AT ORIGIN-END OF TRIP

1.

			Adjusted
Walked	63%	(1708)	64%
Transfer from			
HSR	33%	(900)	34%
GO	<1%		0.4%
CCL	<1%		0.4%
Other	<2%		1.2%
Non-Response	<2%		-
	100%		100%

2. The percent of walk trips was similar for all routes.

3. The non-response rate varied for each route and ranged from .36% to 6.98%.

C. PURPOSE AT ORIGIN (BY ROUTE)

1. Non-response of less than 7% was about the same for each route.

2.

		Adjusted	P.M. Peak Unadjusted
Home	13%	14%	12%
Work	41%	43%	46%
Sch/Univ.	20%	22%	19%
Shop/Per Bus	14%	15%	12%
Soc/Rec	3%	3%	2%
Other	3%	3%	3%
Non-Response	6%	-	6%
	100%	100%	100%

3. Route 28 (Upper James/Claremont) experienced a higher proportion of school trips than other types when compared to other routes; 35% compared to an average of 21%. On this route work trips amounted to 45% of trips which is comparable to the average. However, all other trip purposes for Route 28 were well below the average.

D. PURPOSE AT DESTINATION (BY ROUTE)

1. Non-response was less than 12% with some variation by routes (3.85% -14.74%).

2.

			Adjusted
Home	75%	(similar between routes)	84%
Work	4%		5%
Sch./Univ.	2%		2
Shop/Per Bus	4%		5
Soc/Rec	2%		2
Other	2%		2
Non-Response	11%		-
	100%		100%

3. Moderate variation in percentages by route was observed.

E. HSR TRANSFERS AT DESTINATION-END OF TRIP (BY ROUTE)

1. 121 destination-end transfers.

2. Major transfer to routes:

Route Transferred To		Number of Transfers		Routes "Transferred From" Grouped By Percent of No. of Transfers		
	Route No.	No.	%	10-15%	15-20%	20%
Unkown		25	21			
Delaware	(5)	7	6			25, 28
Fennel	(31)	18	15	28		23, 27
Mohawk	(41)	30	25		24	27, 28
Stny Ck/Saltflt	(45)	6	5			31
Other		35	28			
		121	100			

3. The total distribution of "transfer from" trips by route varied between 3.31% to 17.36%.

Routes with major "transfer from" activity:

Route 24 with 10-15% of 121 trips.
Routes 21, 27 and 28 with 15-20% of 121 trips

F. EGRESS MODE AT DESTINATION-END OF TRIP (BY ROUTE)

1.

			Adjusted
Walked	82%	(2223)	93%
Transfer to			
HSR	5%	(121)	5%
GO	<1%		.1%
CCL	<1%		.1%
Other	<2%		1.8%
Non-Response	12%		-
	100%		100%

2. The percent distribution of trips using the walk mode was similar for all routes.

3. Variation of non-response between routes was between 3%-16%.

G. TRIP FREQUENCY (BY ROUTE)

				Adjusted
1.	5 or more days per week	59%	(1592)	65%
	3-4 days per week	11%	(307)	13%
	1-2 days per week	9%	(253)	10%
	Less Often	11%	(301)	12%
	Non-Response	10%	(250)	-
		100%		100%

2. Non-response varied by route ranging from 4% to 15%.

3. Route 28 (Upper James/Claremont) exhibited the highest percent of high frequency trips. 91% (adjusted) of trips were made three or more times a week on this route.

H. DRIVERS LICENCE (BY ROUTE)

			Adjusted
1.	Licenced	47%	52%
	Non-licenced	44%	48%
	Non-Response	9%	-
		100%	100%

2. Variation by route was moderate for the "licenced" response ranging from 40% to 53%.

I. AUTO AVAILABILITY (BY ROUTE)

			Adjusted
1.	Car Available	26%	33%
	Car not Available	64%	67%
	Non-Response	10%	-
		100%	100%

2. Variation by route was moderate for the response of "car availability" which ranged from 21%-31%.

J. SEX (BY ROUTE)

			Adjusted
1.	Male	31%	34%
	Female	59%	66%
	Non-Response	10%	-
		100%	100%

2. Variation in female riders by route was between 55%-65% with the exception of Route 28 which was 49% (adjusted).

K. DISTRIBUTION OF TRIPS BY ROUTE

Route No.	21	22	23	24	25	26	27	28	32	33	34	Total
No. Trips	329	281	319	266	274	204	408	89	197	205	134	2 706
% Trips	12.2	10.4	11.8	9.8	10.1	7.5	15.1	3.3	7.3	7.6	5.0	100

7. PURPOSE OF DETAILED SURVEY DATA ANALYSIS

The purpose of the analysis was to acquire current information about the p.m. peak travel demand and trip characteristics of Hamilton transit riders. More specifically, the objectives of the analysis were to:

- determine the number of p.m. peak hour transit riders whose trip crossed the escarpment within the proposed ICTS corridor and terminated on the Mountain.

- determine the distribution of p.m. peak hour peak direction trips by origin and destination.

- determine for various Mountain areas, p.m. peak hour per capita ridership for trips which cross the escarpment and terminate on the Mountain.

- determine the number p.m. peak hour transfers which occur in the Central Business District (CBD) for trips terminating on the Mountain.

- determine the p.m. peak hour transit demand for Mountain corridors which would be likely candidates for continued direct surface transit service to the CBD under the proposed ICTS scheme.

8. RIDERSHIP ADJUSTMENT

P.M. peak hour ridership information was determined based on data received from questionnaire surveys and on-board passenger counts. The questionnaire surveys provided detailed information about ridership characteristics for a representative portion of transit riders. The on-board counts provided a basis upon which the results of the questionnaire survey could be factored to represent total passenger ridership. Table 8.1 shows the percent response to questionnaire surveys by route for southbound trips which crossed the escarpment to the Mountain.(1) The average response rate for routes which cross the escarpment within the proposed ICTS corridor was 44.6 percent.(2) Inverted, this value provides a factor of 2.24 by which questionnaire survey results were adjusted to better reflect total ridership.

Due to an observed non-response to particular origin-destination (O-D) information in the questionnnaire survey results, a further non-response adjustment factor of 1.042 was applied.

The survey was conducted during the period between 2:00 p.m. and 6:00 p.m. But because of staggered bus schedules between routes simultaneous data collection for each of the bus routes occurred only during the period from 3:00 p.m. to 5:30 p.m. Table 8.2 shows the number of southbound escarpment riders counted for this period.

Eleven extra buses operated for one to two runs during the survey. The buses were not surveyed. Based on the known bus schedules, the passenger counts on the buses preceding and following bus to the extra

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(1) This type of trip shall be termed hereafter as a southbound escarpment trip.

(2) The Fennell route does not cross the escarpment within the proposed ICTS corridor. Therefore, the results of analysis for the Fennell route are hereafter precluded from this report.

TABLE 8.1

QUESTIONNAIRE SURVEY RESPONSE BY ROUTE(1)

Route	Route Number	Number of Passengers Surveyed	Number of Passengers Counted (2, 4)	Percent Response
Upper Kenilworth	21	367	753	49
Upper Ottawa	22, 22A	317	737	43
Upper Gage	23, 23A	402	977	41
Upper Sherman	24, 24A	311	876	36
Upper Wentworth	25	330	628	53
Upper Wellington	26	226	581	39
Upper James	27, 27A	563	1 336	42
Upper James Claremont	27B	91	177	51
Fennell	31, 31A, 31B	472	1 222	39
Garth	32	257	568	45
Sanatorium	33	240	554	43
Upper Paradise	34	168	349	48
TOTAL		3 717	8 758	44.1(3)
TOTAL EXCLUDING FENNEL ROUTE		3 245	7 536	44.6(3)

(1) Based on Survey Period 2:00 p.m. - 6:00 p.m.

(2) Includes Estimate of Passenger Volumes on Extra Buses.

(3) Average Percent Response.

(4) At Escarpment.

...s were averaged. It was assumed that this resultant average represented the passenger ridership on the extra bus. Table 8.2 has incorporated these adjustments.

Even though passenger counts are not without human error (i.e. counts taken during crush loading conditions) this table serves to determine the p.m. peak hour factor for which the 3:00 p.m. to 5:30 p.m. data was converted to represent p.m. peak hour conditions. The p.m. peak hour for all routes combined was found to occur between 4:00 p.m. and 5:00 p.m. A factor of 0.46 was derived from the averaging of the p.m. peak hour factors calculated for each route. After this factor was applied, a total p.m. peak hour southbound escarpment ridership of 2 120 riders resulted.

A comparison was made between the adjusted p.m. peak hour southbound escarpment ridership for each route and historical data provided by the Hamilton Street Railway Company. Some minor differences were observed. Once adjustments were made to account for these discrepancies, the final adjusted p.m. peak hour southbound escarpment ridership totalled 2 303. Table 8.3 shows the corresponding final adjusted ridership for each route.

TABLE 8.2

SOUTHBOUND PASSENGER RIDERSHIP
CROSSING THE ESCARPMENT(1, 2)

oute Name	Upper Kenilworth	Upper Ottawa	Upper Gage	Upper Sherman	Upper Wentworth	Upper Wellington	Upper James	Upper James Claremont	Garth	Sanatorium	Upper Paradise	Total
oute Number	21	22, 22A	23, 23A	24, 24A	25	26	27, 27A	27B	32	33	34	
ime												
:00-3:15	47	49	15	30	13	33	78	25	13	13	Ø	316
15-3:30	14	Ø	44	52	54	31	44	17	24	Ø	14	294
30-3:45	24	28	42	37	34	39	Ø	12	32	50	12	310
45-4:00	25	30	Ø	47	39	52	107	10	29	29	59	427
00-4:15	51	49	124	61	36	57	68	12	29	57	26	580
15-4:30	35	62	58	80	84	30	38	18	48	27	Ø	497
30-4:45	38	41	80	31	26	38	90	24	85	28	20	471
45-5:00	49	63	33	72	34	74	110	5	28	38	18	534
00-5:15	38	84	101	54	42	38	64	10	55	43	46	569
15-5:30	19	23	36	17	25	30	53	Ø	60	46	42	351
00-5:30												
tal	340	429	533	481	357	422	670	130	377	331	237	4 307
ute Peak Hour												
tal	160	250	295	244	156	199	324	61	202	163	126	2 180
stem Peak Hour												
tal												
00-5:00	173	215	295	244	150	199	324	56	170	150	64	2 040
stem Peak Hour												
tal												
00-5:30 p.m.												
tal	.51	.50	.55	.51	.44	.47	.48	.43	.45	.45	.27	.46

) Based on 3:00-5:30 p.m. on-board counts.

) Includes estimates of passenger volumes on extra buses.

Peak Period
All Routes Surveyed

Peak Hour for Route

TABLE 8.3

PEAK HOUR SOUTHBOUND CBD/MOUNTAIN
RIDERSHIP BY ROUTE

Route Name	Route Number	Peak Hour Ridership	Percent of Total Peak Hour Ridership
Upper Kenilworth	21	207	9.0
Upper Ottawa	22, 22A	215	9.4
Upper Gage	23, 23A	295	12.8
Upper Sherman	24, 24A	244	10.6
Upper Wentworth	25	175	7.6
Upper Wellington	26	265	11.5
Upper James	27, 27A	380	16.5
Upper James Claremont	27B	69	3.0
Garth	32	185	8.0
Sanatorium	33	150	6.5
Upper Paradise	34	118	5.1
		2 303	100.0

9. GENERAL P.M. PEAK HOUR RIDERSHIP CHARACTERISTICS

Over 77 percent of southbound riders on Mountain bus routes crossed the escarpment to the Mountain during the p.m. peak hour. Only 6.3% started and ended below the escarpment, and 16% started and ended on the Mountain. Figure 9.1 illustrates these figures.

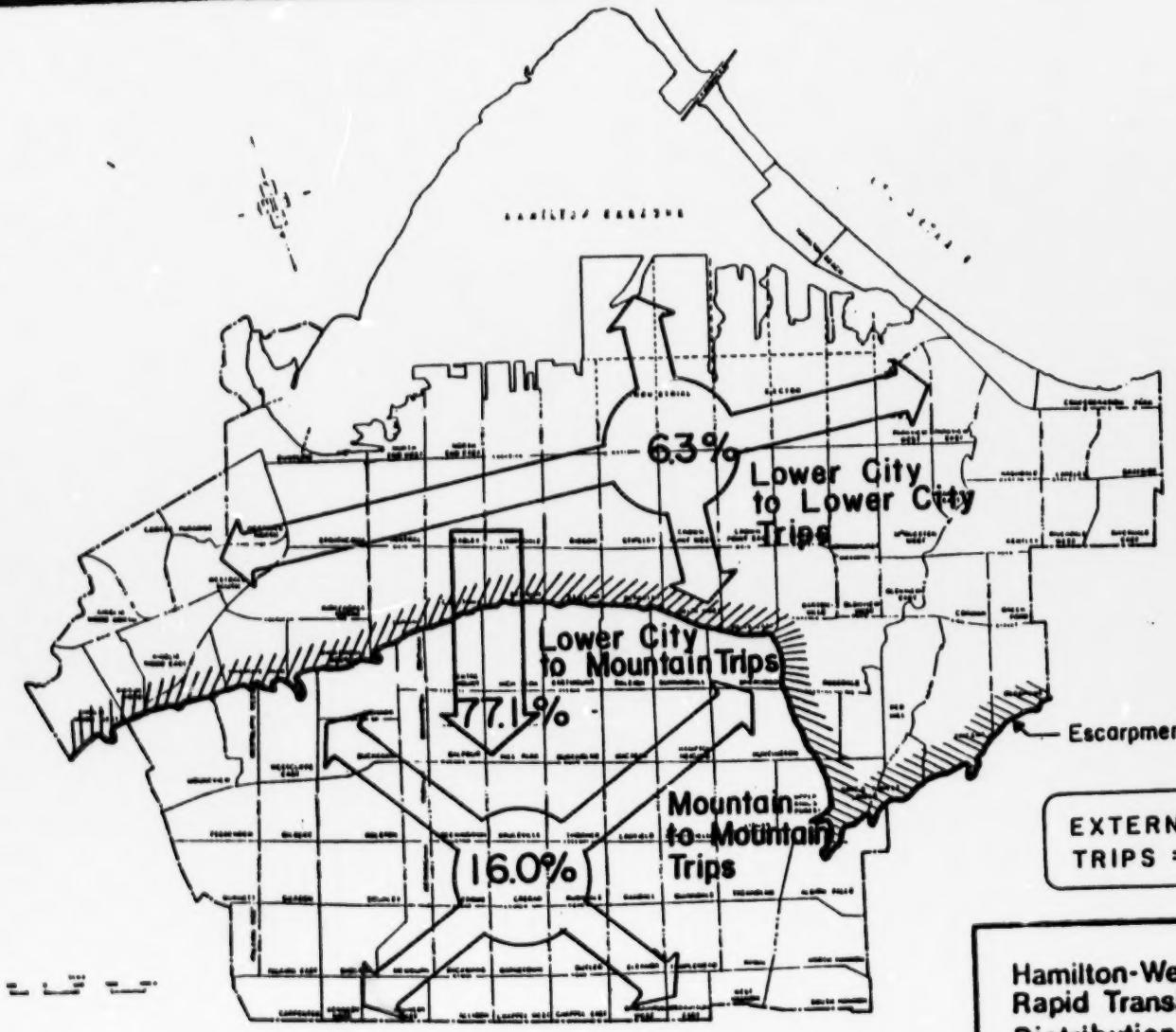
The neighbourhood zones of the Mountain and of the CBD were compressed into larger superzones. Figure 9.2 shows the percent distribution of p.m. peak hour trips which boarded in the CBD and terminated on the Mountain. Over 53 percent of such trips are shown to be destined to the two central Mountain superzones which correspond approximately to the proposed ICTS corridor. Over 35 percent of the trips are concentrated north of Mohawk Road within the Corridor area.

Per capita ridership factors for p.m. peak hour southbound ridership were derived for each Mountain neighbourhood zone. The "per capita" ridership is the number of southbound escarpment trips destined to the zone during the one peak hour surveyed, expressed as a ratio to the current neighbourhood population. To estimate the annual per capita ridership, these figures should be multiplied by 315. These results were compressed into the superzone results shown in Figure 9.3 [1,2] By plotting these per capita ridership values against the linear distance between the centre of the CBD and the centre of the respective superzones, a classical decay curve results. This is illustrated in Figure 9.4. With the exception of only one point, the curve shows per capita ridership of superzones to decrease as the their distance from the CBD increases.

---

(1) The compressed per capita ridership values are based on the per capita ridership of neighbourhood zones which currently are developed to at least 50 percent. This was done to reduce the possible influence of statistical fluctuation.

(2) By compressing the neighbourhood per capita ridership values, the possible error produced from the method by which trip destinations were assigned to the neighbourhood zones would be reduced.



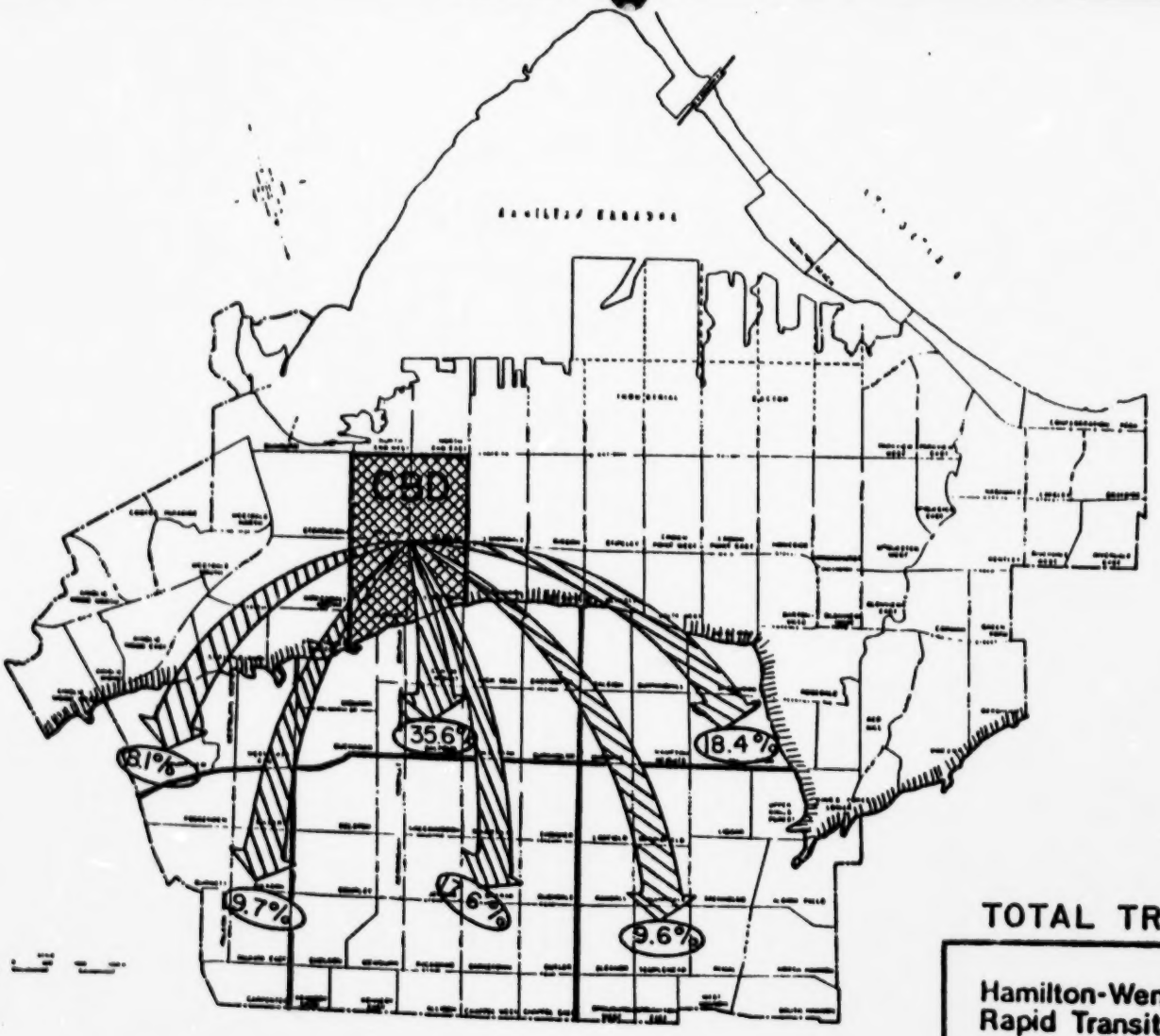
EXTERNAL - RELATED TRIPS = 0.6 %

(1) BASED ON 3.00 PM TO 5.30 PM SURVEY PERIOD

Hamilton-Wentworth Rapid Transit Project
Distribution of Southbound Transit Trips by City Area (1)

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.
Barton Myers Associates

Figure 9.1



TOTAL TRIPS = 2303

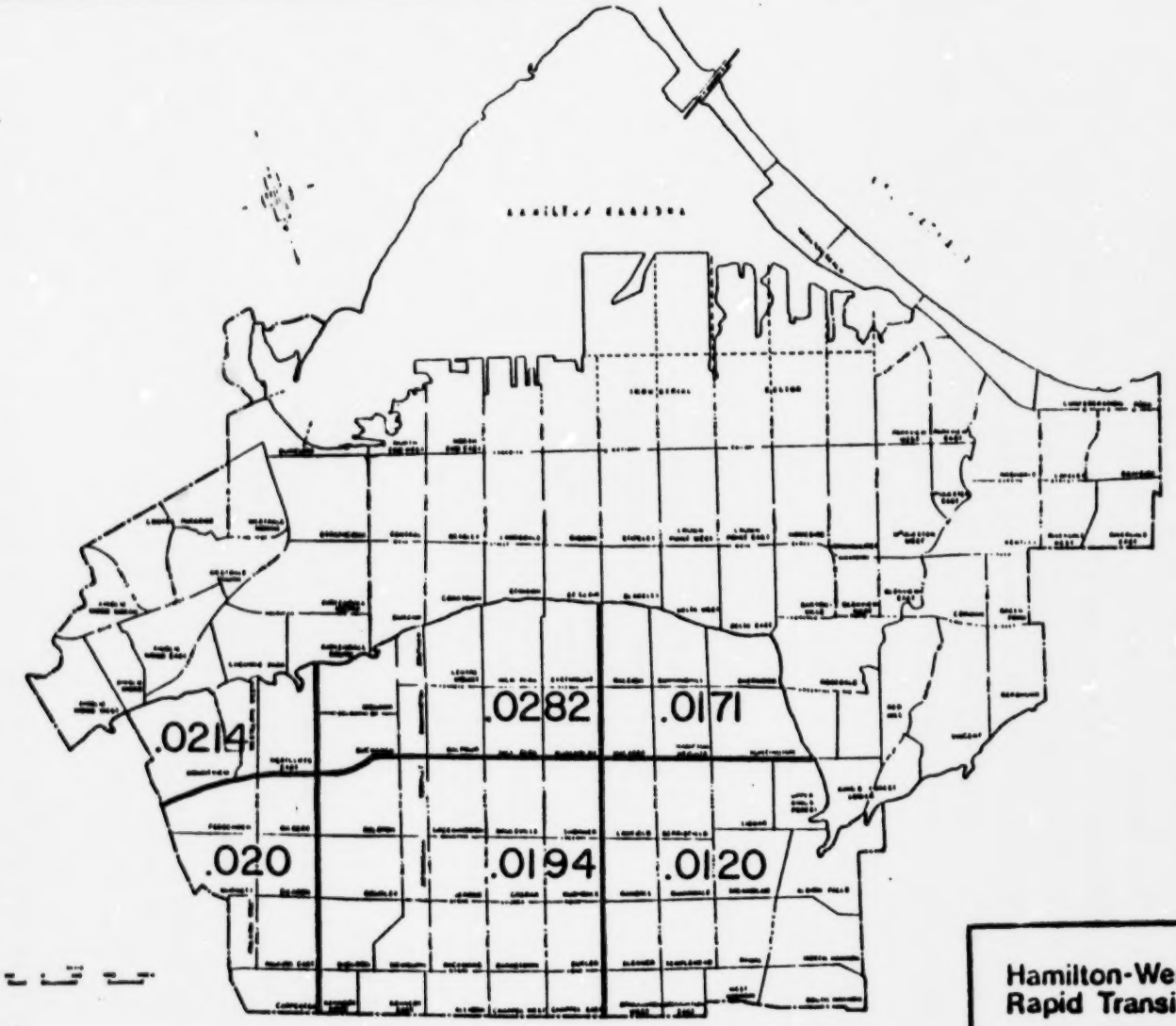
Hamilton-Wentworth
Rapid Transit Project

Percent Distribution of
Southbound CBD/Mountain
Peak Hour Trips

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.
Barton Myers Associates

Figure 9.2

URBAN DOCUMENTATION CENTRE
RESEARCH UNIT FOR URBAN STUDIES
McMASTER UNIVERSITY
HAMILTON, ONTARIO



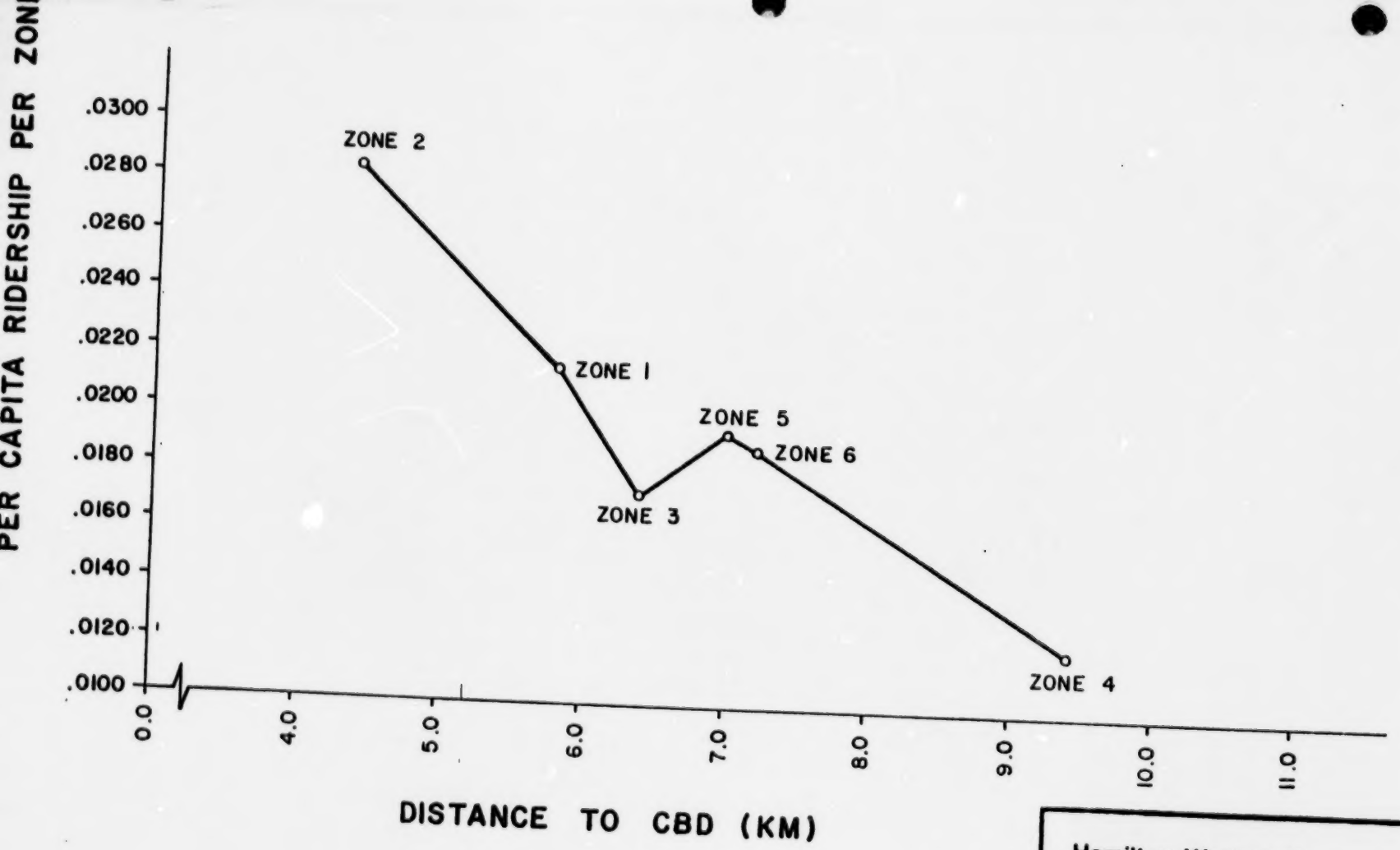
(1) Per Capita values calculated on basis of zones with 50% development in 1980.

Hamilton-Wentworth
Rapid Transit Project

PER CAPITA .
Peak Hour CBD/Mountain
Ridership by Superzone (1)

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.
Barton Myers Associates

Figure 9.3



(1) CBD / MTN TRIPS ONLY

(2) DISTANCE MEASURED FROM CENTRE OF ZONE TO CENTRE OF CBD

Hamilton-Wentworth Rapid Transit Project

Per Capita Ridership of Superzones VS Distance from CBD

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.
Barton Myers Associates

Figure 9.4

10 ORIGINS-DESTINATIONS

10.1 Origins

The distribution of p.m. peak hour southbound escarpment trip origins is detailed in Figure 10.1. Over 75 percent (1 736) of these trips originate within the CBD area. Figure 10.2 examines the distribution of boardings within the CBD and shows that over 74 percent (1 713) of the trips board at Gore Park. The next largest boarding point is St. Joseph's Hospital which accounts for about 5 percent (119) of the trips. Other major boarding points are the intersections of James Street/King Street and James Street/Main Street which each account for about 3 percent of the trips.(1)

10.2 Destinations

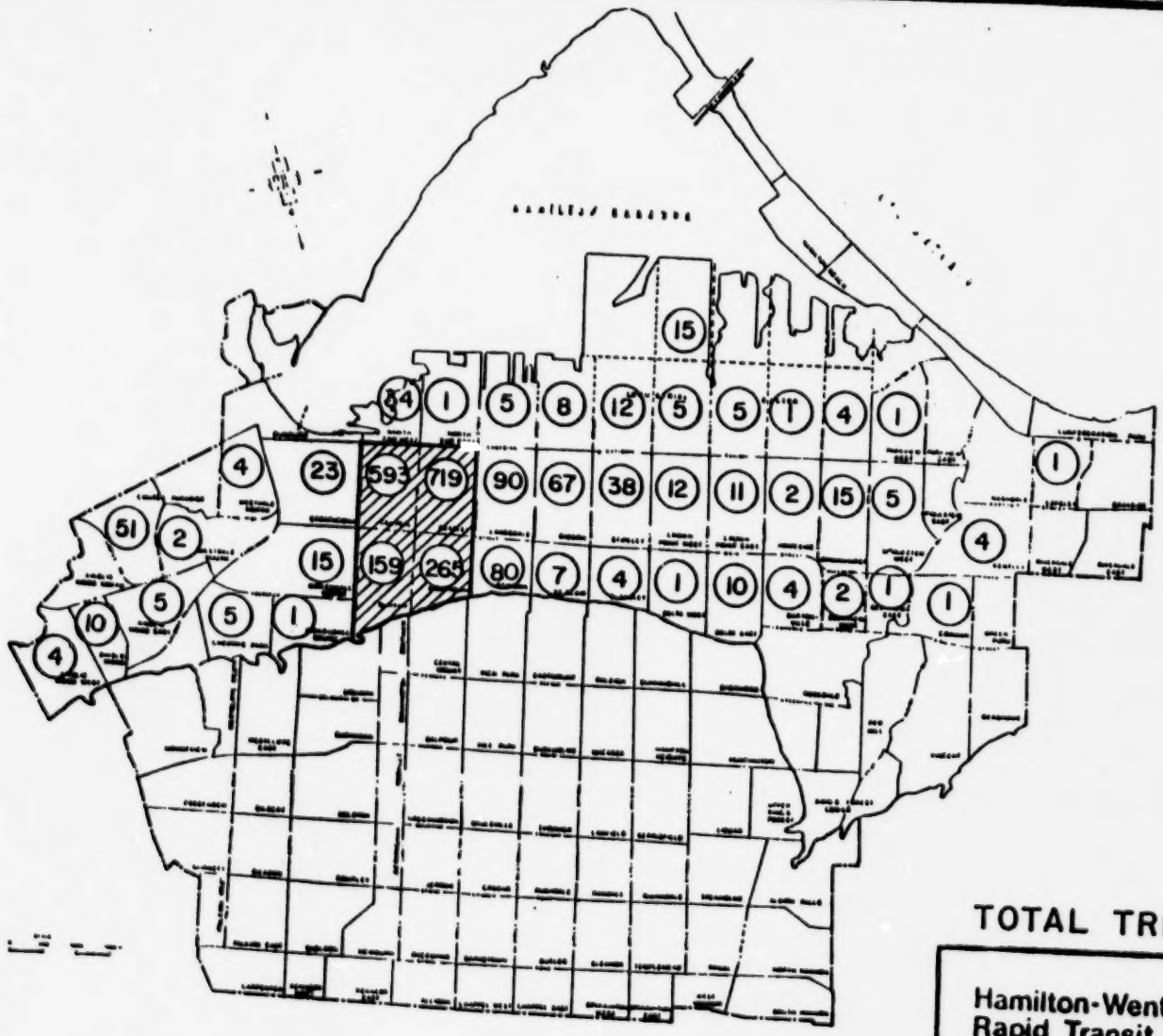
Figure 10.3 shows the distribution of p.m. peak hour southbound escarpment trip destinations. Generally speaking, the highest concentration of trip destinations is in areas north of Mohawk Road. This result corresponds directly with current population densities and residential development known for these neighbourhood areas. As was demonstrated in Section 9 , the results of Figure 10.3 show that the area approximating the proposed ICTS corridor attracted the greatest ridership.

P.M. peak hour southbound trips which originated and terminated below the Mountain totalled 188. Figure 10.4 shows the distribution of these trips by neighbourhood zone. 81 percent (154) of the trips terminated within the CBD area. Figure 10.5 shows the distribution of peak hour deboardings within the CBD area.(2) The major attraction of these trips appears to be St. Joseph's Hospital.

---

(1) 104 boardings were determined to be specific to the CBD area but the actual boarding points were unknown. For this reason the figures quoted in Section 10.1 are slightly low.

(2) An accurate interpretation of these results is doubtful because of the relatively large proportion of trips for which the deboarding locations are not known.



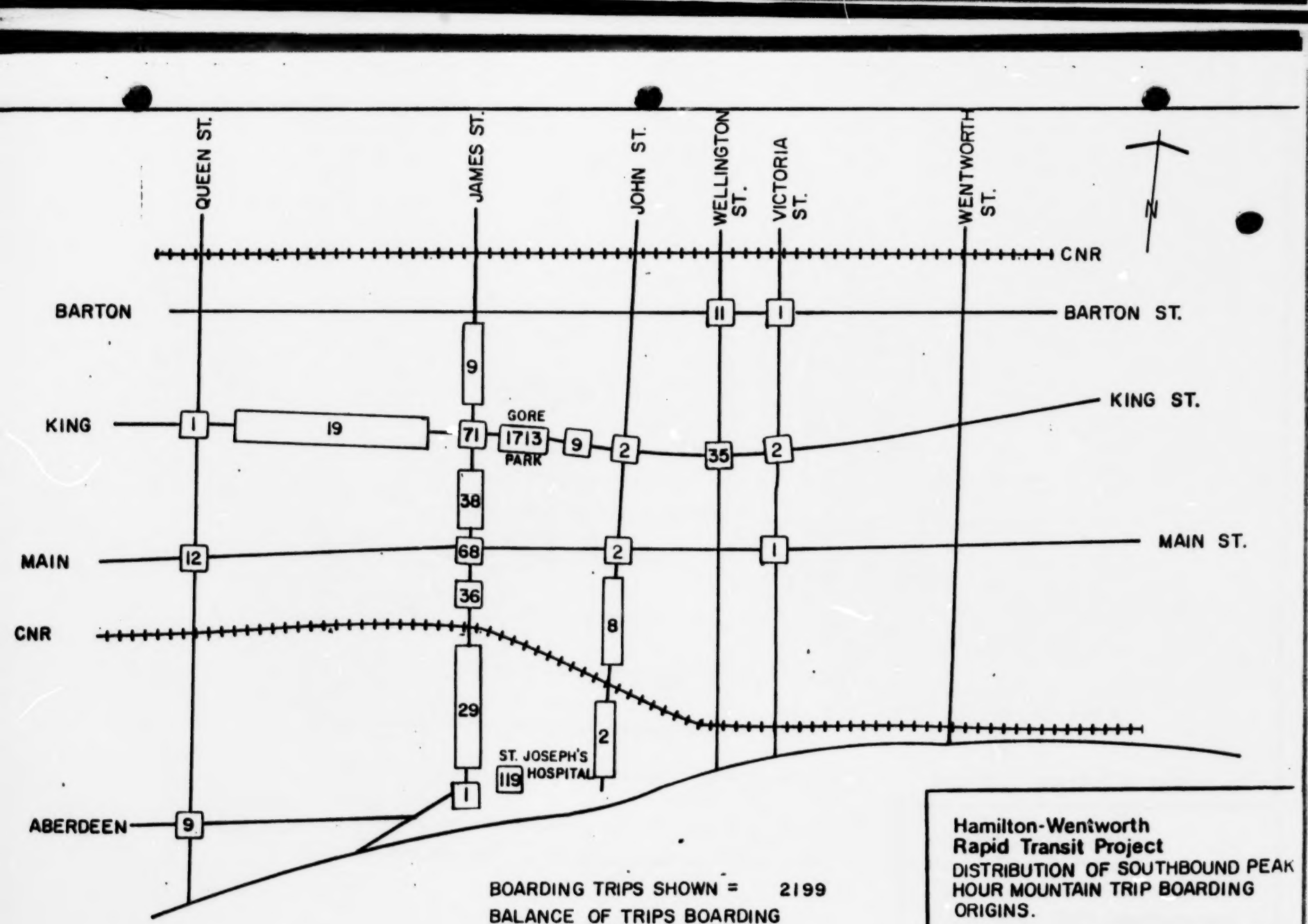
TOTAL TRIPS = 2303

Hamilton-Wentworth
Rapid Transit Project
Distribution of Total
Southbound Peak Hour
Mountain Trip Origins

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.

Barton Myers Associates

Figure 10.1



BOARDING TRIPS SHOWN = 2199

BALANCE OF TRIPS BOARDING WITHIN THE DEFINED AREA BUT SPECIFIC BOARDING PT. UNKNOWN. = 104

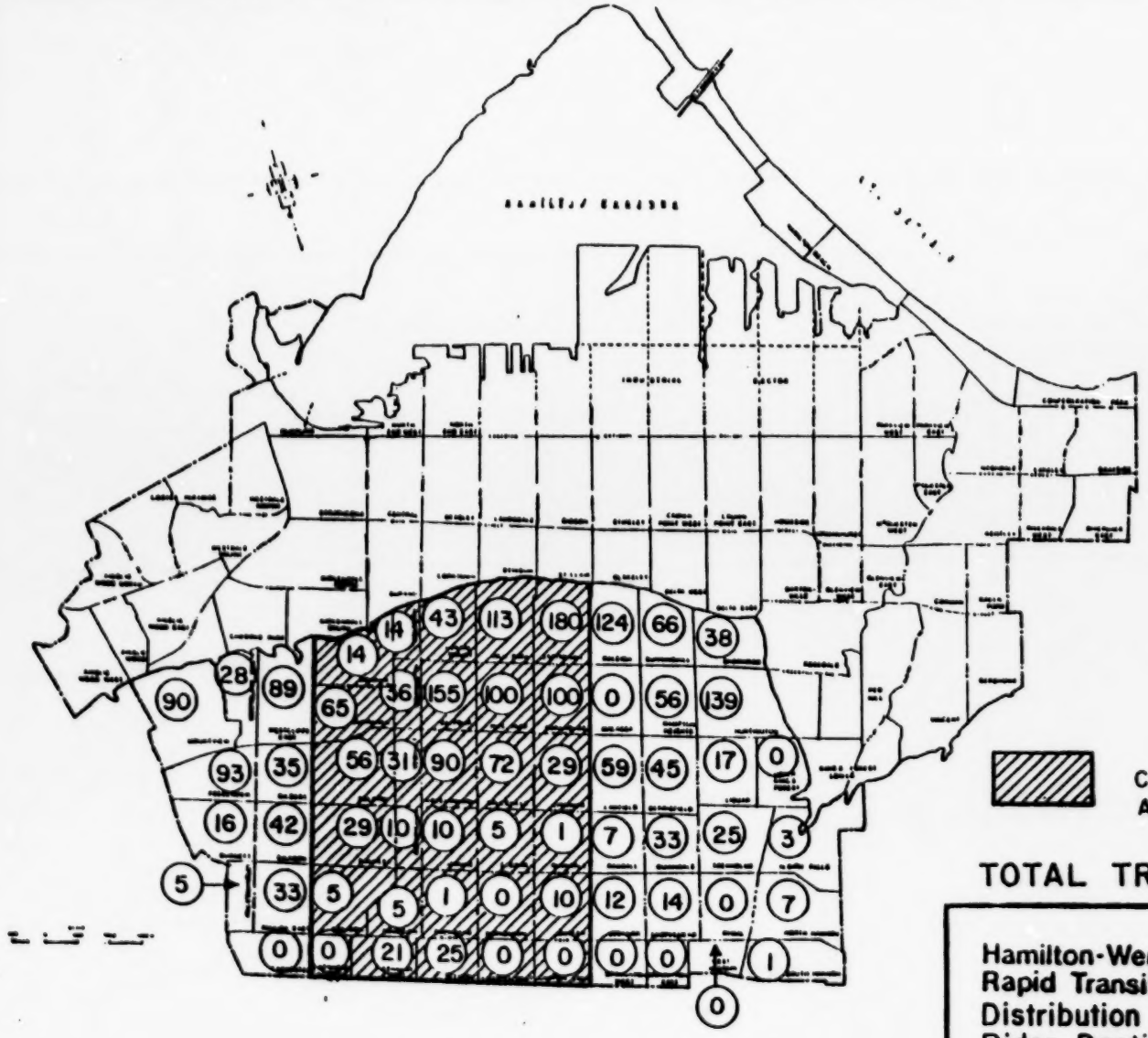
TOTAL TRIPS = 2303

Hamilton-Wentworth Rapid Transit Project

DISTRIBUTION OF SOUTHBOUND PEAK HOUR MOUNTAIN TRIP BOARDING ORIGINS.

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.
Barton Myers Associates

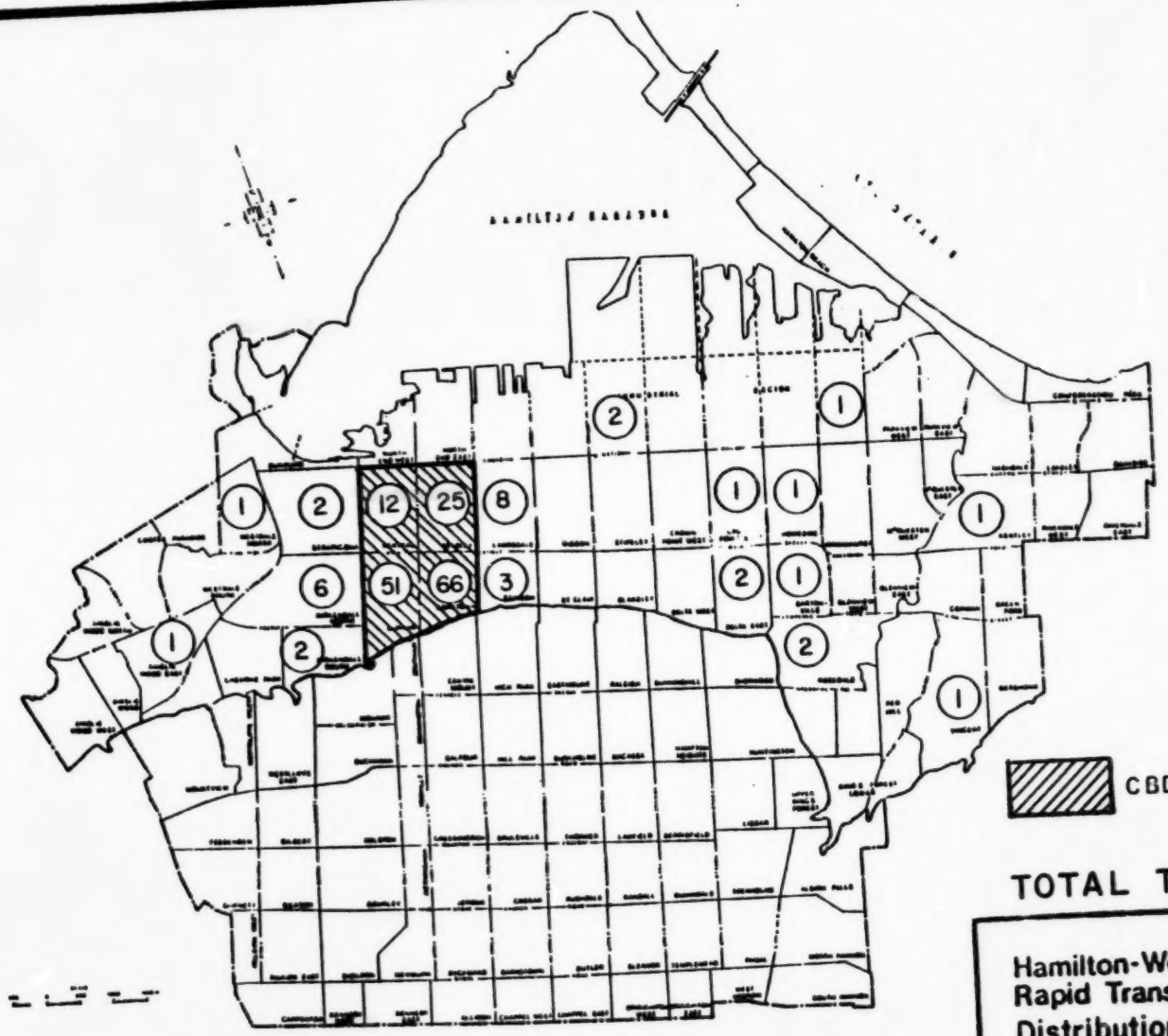
FIG. 10.2



Hamilton-Wentworth Rapid Transit Project
Distribution of Peak Hour Rider Destinations for Trips Originating Below the Mountain

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.
Barton Myers Associates

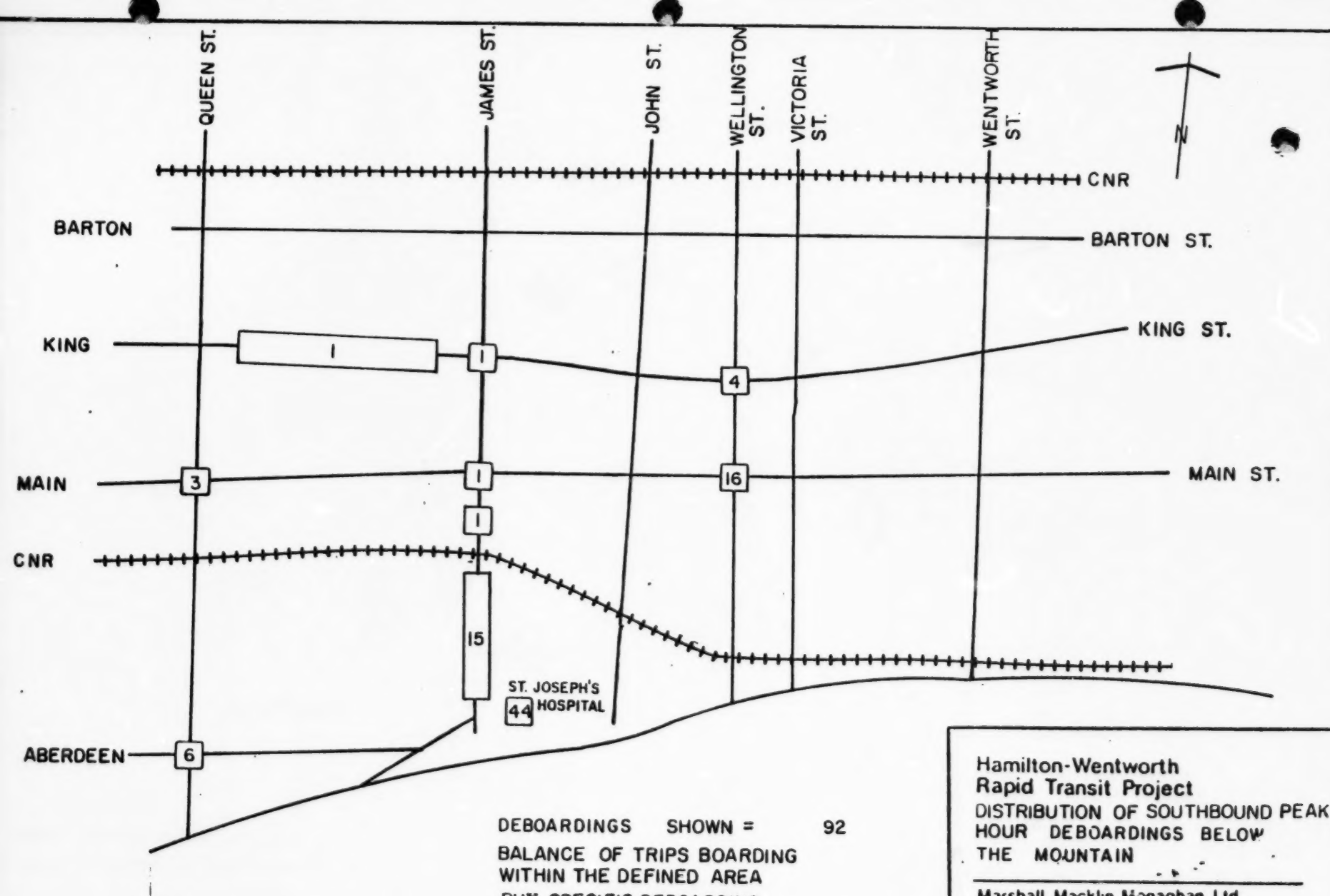
Figure 10.3



Hamilton-Wentworth
Rapid Transit Project
Distribution of Southbound
Peak Hour Trip Destinations
Below the Mountain

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.
Barton Myers Associates

Figure 10.4



DEBOARDINGS SHOWN = 92

BALANCE OF TRIPS BOARDING WITHIN THE DEFINED AREA BUT SPECIFIC DEBOARDING POINT UNKNOWN. = 96

= 188

Hamilton-Wentworth
Rapid Transit Project

DISTRIBUTION OF SOUTHBOUND PEAK HOUR DEBOARDINGS BELOW THE MOUNTAIN

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.
Barton Myers Associates

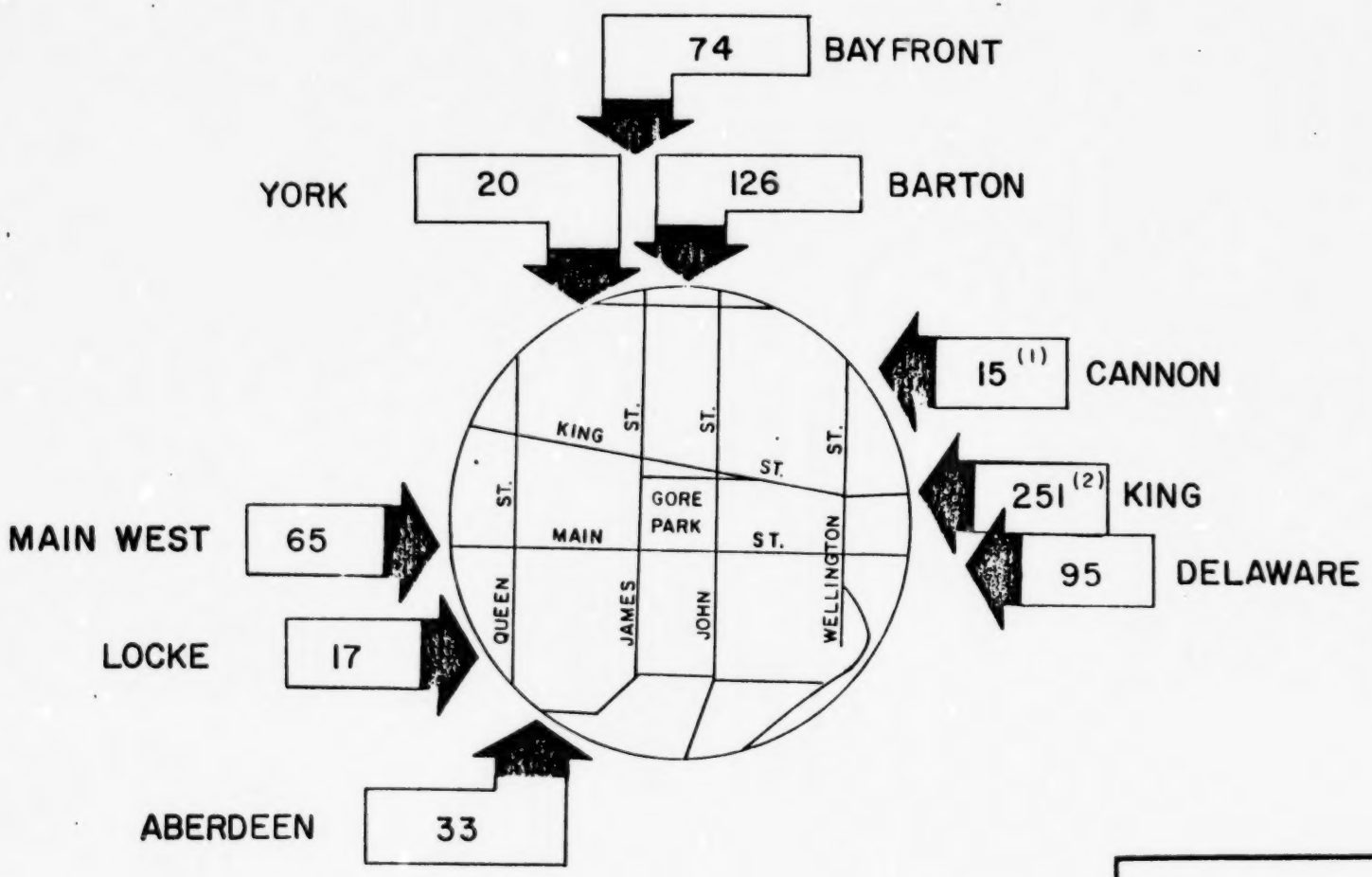
FIG. 10.5

11. TRANSFERS

With reference to findings documented in the preceding report sections, only 7 percent of southbound escarpment trips needed to transfer to another HSR bus on the Mountain. For this reason, further analysis of transfer activity on the Mountain was not addressed.

To facilitate southbound escarpment trips 33 percent (759) of the total trips made transfers in the CBD during the p.m. peak hour. Figure 11.1 shows the distribution of transfers made from connecting bus routes which service the Lower Hamilton area and the direction from which the trips originated.

Table 11.1 further details the transfer activity in the CBD. The Lower Hamilton routes which are the major generators of transfers are King trolley (33.1% of the transfers), Main West/Delaware (21.1%) and Barton trolley (16.7%). Combined, these total over 70 percent (537) of the transfers made during the p.m. peak hour.



1) plus 1 transfer at Wellington st.
2) plus 10 transfers at Wellington st.
* EXCLUDES NW MOUNTAIN.

Legend

95 Number of Transfers Via Route Indicated

TOTAL = 696

Hamilton-Wentworth Rapid Transit Project

TRANSFER ACTIVITY AT GORE PARK BY TRANSFER ROUTE FOR SB. PK. HR TRIPS UP THE MTN.

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.
Barton Myers Associates

Figure 11.1

TABLE 11.1

CBD TRANSFER ACTIVITY FOR
MOUNTAIN-DESTINED ROUTES BY LOWER CITY ROUTE
(P.M. PEAK HOUR 4:00 P.M. - 5:00 P.M.)

Route Transferred From	Route No.	Route Transferred To: 21	22, 22A	23, 23A	24, 24A	25	26	27, 27A	27B	32	33	34	Total	% by Sub-Total	% by Total
King	- 1	12	13	23	27	39	10	48	10	16	29	24	251	33.1	10.9
Barton	- 2	10	5	18	15	18	17	17	6	9	6	5	126	16.7	5.5
Cannon	- 3	1	0	0	0	1	2	4	1	1	3	2	15	2.0	0.7
Bayfront	- 4	0	4	11	5	7	9	11	3	13	7	4	74	9.7	3.2
Main-West Delaware	- 5	25	25	10	16	11	25	21	0	13	4	10	160	21.1	6.9
Aberdeen	- 6	6	0	3	1	5	4	3	0	0	4	7	33	4.3	1.4
Locke	- 7	0	6	5	3	0	1	1	0	0	0	1	17	2.2	0.7
York	- 8	2	2	0	1	1	4	7	0	3	0	0	20	2.6	0.9
Other - CCL - GO - Other		11	5	9	6	8	1	14	4	2	0	3	63	8.3	2.7
Sub-Total		67	60	79	74	90	73	126	24	57	53	56	759	100	33.0
% Distribution		8.8	7.9	10.3	9.7	11.9	9.6	16.5	3.2	7.5	7.4	7.4	100	-	-
Non-Transfer Boardings		180	165	168	148	182	124	230	50	103	123	71	1 544		67.0
Total		247	225	247	222	272	197	356	74	160	176	127	2 303		100

12. TRANSIT DEMAND IN SPECIFIC MOUNTAIN CORRIDORS

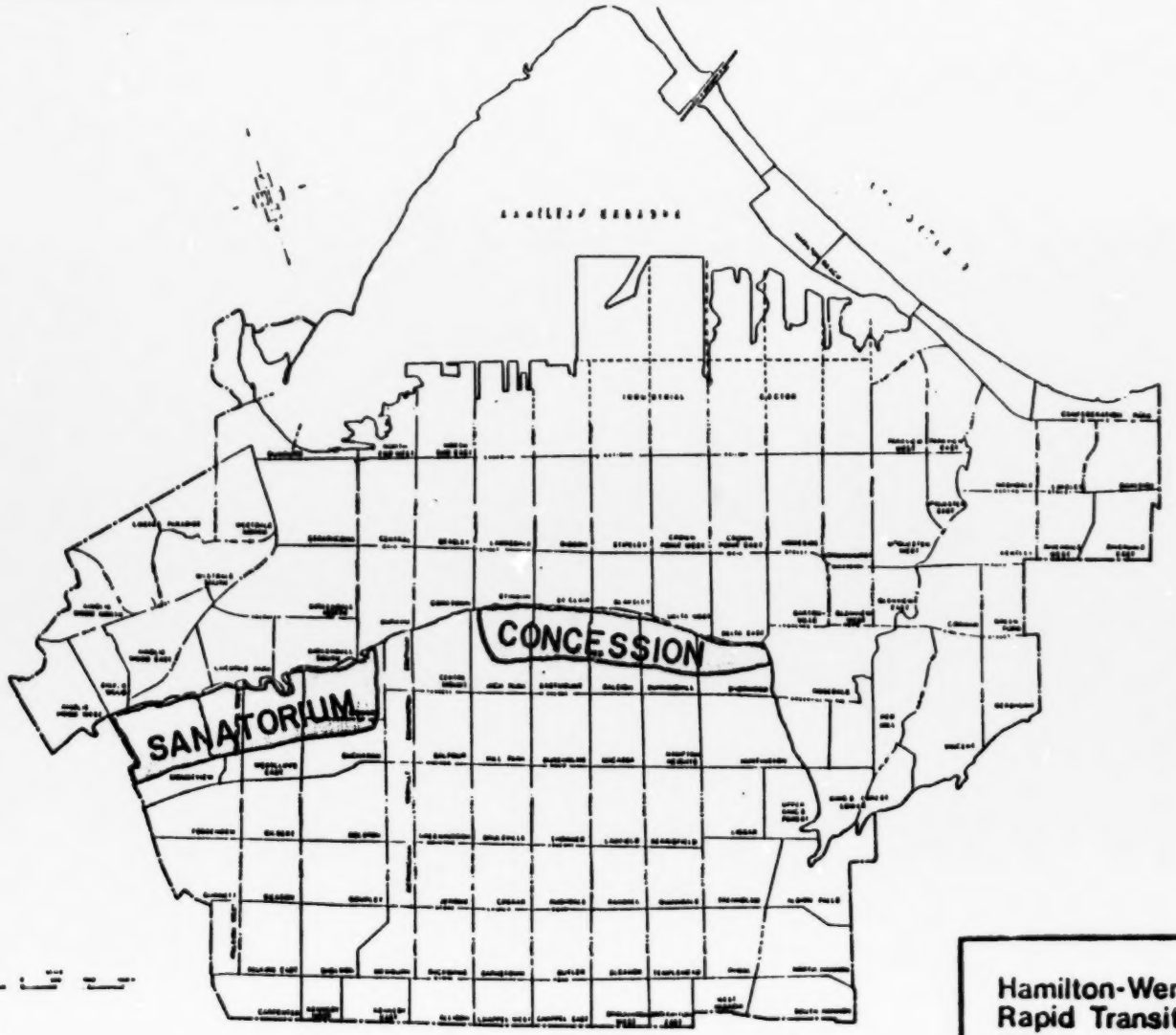
It is conceivable that if the proposed ICTS system is installed, certain Mountain corridors currently served by bus to the CBD may, by means of planning policy, have this service continued. For this reason, information about the current transit demand for such corridors may be required.

Two corridors where this may occur are:

1. the Mountain area served by the Sanatorium route which accesses the Mountain by way of Beckett Drive.

2. the Mountain area served by bus routes which travel Concession Street with access to the Mountain by way of the Jolley Cut.

The bus catchment areas assumed for these two corridors are illustrated in Figure 12.1. The southbound escarpment ridership for the Sanatorium corridor was estimated to be 196 (8.5% of total ridership) during the p.m. peak hour. The Concession corridor resulted in an estimated ridership of 256 (11.1%).



CONCESSION CORRIDOR – 256 TRIPS
SANATORIUM CORRIDOR – 196 TRIPS

Hamilton-Wentworth Rapid Transit Project
Passenger Catchment Area for Sanatorium and Concession Corridors

Marshall Macklin Monaghan Ltd.
Hatch Associates Ltd.
Barton Myers Associates

Figure 12.1

13. CONCLUSIONS

The following points highlight the major conclusions of this report:

- the p.m. peak hour for all the Mountain bus routes combined was 4:00 p.m. to 5:00 p.m. The peak direction was southbound.

- the total number of trips which originated below the Mountain and terminated on the Mountain (southbound escarpment trips) during the p.m. peak hour was 2 303.

- over 77 percent (2 303) of southbound riders on Mountain bus routes crossed the escarpment to the Mountain during the p.m. peak hour.

- p.m. peak hour southbound escarpment per capita ridership of Mountain zone decreased as the distance from the CBD increased.

- over 75 percent of p.m. peak hour southbound escarpment trips originated in the CBD area.

- over 74 percent of the p.m. peak hour southbound escarpment trips boarded at Gore Park.

- 33 percent of p.m. peak hour southbound escarpment trips transferred to the Mountain bus route in the CBD while only 7 percent transferred from the bus routes on the Mountain.

- the p.m. peak hour southbound escarpment riderships for the Mountain corridor serviced by the Sanatorium route and the Concession Street corridor were estimated to be 196 and 256, respectively.

APPENDIX A

Map of HSR Bus Routes Surveyed